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10/670,014	09/23/2003	Michael Frank	PIX-P-057	4544

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EXAMINER	
KHAN, USMAN A	
ART UNIT	PAPER NUMBER
2622	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/07/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/670,014	FRANK ET AL.	
	Examiner	Art Unit	
	Usman Khan	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,7-13 and 16-20* is/are rejected.

7)☒ Claim(s) *5-6 and 14-15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 09/23/2003 has been considered by the examiner. The submission is in compliance with the provisions of 37 CFR 1.97.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 4, 7 - 13, and 16 - 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Bakhle et al. (US patent No. 6,061,092).

Regarding **claim 1,** Bakhle et al. teaches a method for subtracting fixed pattern noise in a digital imaging system incorporating a digital image sensor (abstract and column 2 lines 39 *et seq.*), comprising: acquiring a reference image of the digital image sensor when the digital image sensor receives no illumination (column 2 lines 39 *et*

seq.; i.e. dark images); storing a reference value of an operating parameter associated with the reference image (column 2 lines 39 *et seq.* and column 4 lines 26 *et seq.*), wherein the reference image is indicative of the fixed pattern noise associated with the digital image sensor when the operating parameter has the reference value (column 2 lines 39 *et seq.* and column 4 lines 26 *et seq.*); storing a model describing the behavior of the fixed pattern noise as a function of the operating parameter (column 2 lines 39 *et seq.*, column 4 lines 26 *et seq.*); acquiring a first image (column 2 lines 39 *et seq.*; i.e. current frame); measuring a current value of the operating parameter associated with the first image (column 2 lines 39 *et seq.*; i.e. current reference data); calculating a noise prediction image by extrapolation of the reference image in accordance with the model and based on the current value and the reference value of the operating parameter (column 2 lines 39 *et seq.* and column 4 lines 26 *et seq.*); and subtracting the noise prediction image from the first image to generate a final image (column 2 lines 39 *et seq.*; i.e. noise cancellation process).

Regarding **claim 4**, as mentioned above in the discussion of claim 1, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches the operating parameter comprises a temperature of the digital image sensor (column 3 lines 54 *et seq.*).

Regarding **claim 7**, as mentioned above in the discussion of claim 1, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches

the operating parameter comprises **one of** a temperature, an operating voltage, an exposure time, a location of the pixels in the digital image sensor, and the reset voltage of the digital image sensor (column 3 lines 54 *et seq.*; i.e. temperature).

Regarding **claim 8**, as mentioned above in the discussion of claim 1, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches that subtracting the noise prediction image from the first image comprises: determining an illumination level of the first image (column 2 lines 55 *et seq.*; it is inherent when the reference data is matched with the dark column the illumination level of the reference image is measured); and subtracting the noise prediction image from the first image only when the illumination level is less than a pre-determined threshold (column 2 lines 55 *et seq.*; reference data is matched with the dark column when the reference data reaches a value to match the dark column values).

Regarding **claim 9**, as mentioned above in the discussion of claim 8, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches determining an illumination level of the first image comprises: averaging a plurality of pixel values from the first image, the plurality of pixel values being selected from pixels distributed across the digital image sensor (figure 2, item 41; dark images arrayed and used as reference images).

Regarding **claim 10**, as mentioned above in the discussion of claim 1, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches subtracting the noise prediction image from the first image comprises: determining an illumination level of the first image (column 2 lines 55 *et seq.*; it is inherent when the reference data is matched with the dark column the illumination level of the reference image is measured); storing the noise prediction image in m bits when the illumination level is less than a pre-determined threshold; storing the noise prediction image in n bits, where n is less than m, when the illumination level is greater than a pre-determined threshold (figure 5); and subtracting the noise prediction image from the first image (column 2 lines 39 *et seq.*; i.e. noise cancellation process).

Regarding **claim 11,** Bakhle et al. teaches an imaging system, comprising: a digital image sensor for performing image capture operations, comprising: a sensor array comprising a two-dimensional array of digital pixels (figure 4A and 4B), each digital pixel outputting digital signals as pixel data representing an image of a scene (column 5 lines 23 *et seq.*; it is inherent that the CMOS sensor, which includes pixels, outputs a digital signal that is sent for processing); image buffer, in communication with the sensor array, for storing the pixel data (figure 2 item 48); and a first processor, in communication with the image buffer and the sensor array, for controlling image capture and pixel data processing operations (figure 2, item 32); and a digital image processor for performing image processing operations (figure 2, item 42; and column 4 lines 16 *et seq.*), comprising: a frame buffer, in communication with the digital image sensor,

coupled to store the pixel data, wherein the frame buffer includes a first bit field for storing the pixel data for a first image and a second bit field for storing noise data associated with the sensor array (figure 2, item 42; and column 4 lines 16 *et seq.*); a second processor, in communication with the frame buffer, for processing the pixel data stored in the frame buffer (figure 2, item 38; and column 4 lines 16 *et seq.*); and a memory buffer, in communication with the second processor, for storing a reference image of the sensor array and a reference value of an operating parameter (figure 2, item 38; and column 4 lines 16 *et seq.*), wherein the reference image is indicative of the fixed pattern noise associated with the digital image sensor when the operating parameter has the reference value (figure 2, item 38; and column 2 lines 39 *et seq.*), wherein when the digital image sensor captures a first image (column 2 lines 39 *et seq.*; i.e. current frame), a current value of the operating parameter when the first image is acquired is measured (column 2 lines 39 *et seq.*; i.e. current reference data); the second processor generates the noise data by extrapolating the reference image based on the reference value and the current value of the operating parameter and a model describing the behavior of the fixed pattern noise as a function of the operating parameter (column 2 lines 39 *et seq.* and column 4 lines 26 *et seq.*).

Regarding **claim 12**, as mentioned above in the discussion of claim 11, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches the reference image of the sensor array comprises an image of averaged pixel values of

a plurality of images acquired using the digital image sensor when the digital image sensor receives no illumination (column 2 lines 39 *et seq.*; i.e. dark images).

Regarding **claim 13**, as mentioned above in the discussion of claim 11, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches the operating parameter comprises a temperature of the digital image sensor (column 3 lines 54 *et seq.*).

Regarding **claim 16**, as mentioned above in the discussion of claim 11, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches the operating parameter comprises **one of** a temperature, an operating voltage, an exposure time, a location of the pixels in the digital image sensor, and the reset voltage of the digital image sensor (column 3 lines 54 *et seq.*; i.e. temperature).

Regarding **claim 17**, as mentioned above in the discussion of claim 11, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches the second processor subtracts the noise data from the pixel data to generate a final image (column 2 lines 39 *et seq.*; i.e. noise cancellation process).

Regarding **claim 18**, as mentioned above in the discussion of claim 17, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches the second processor subtracts the noise data from the pixel data to generate a final

image only when an illumination level of the first image is less than a pre-determined threshold (column 2 lines 55 *et seq.*; reference data is matched with the dark column when the reference data reaches a value to match the dark column values).

Regarding **claim 19**, as mentioned above in the discussion of claim 17, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches the digital image processor further comprises a lookup table in communication the frame buffer and the second processor and operating to perform the subtraction of the noise data from the pixel data of the first image (figure 2; item 48 and column 2 lines 39 *et seq.*).

Regarding **claim 20**, as mentioned above in the discussion of claim 17, Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches the digital image processor further comprises an arithmetic unit in communication with the frame buffer and the second processor and operating to perform the subtraction of the noise data from the pixel data of the first image (figure 2; item 38).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2 - 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bakhle et al. (US patent No. 6,061,092) in further view of Acks et al. (US patent No. 5,912,934).

Regarding **claim 2**, as mentioned above in the discussion of claim 1 Bakhle et al. teaches all of the limitations of the parent claim. Additionally, Bakhle et al. teaches wherein acquiring a reference image of the digital image Sensor comprises: acquiring a plurality of images using the digital image sensor when the digital image sensor receives no illumination (column 2 lines 39 *et seq.*; i.e. dark images)

However, Bakhle et al. teach for each pixel in the digital image sensor, averaging pixel values of the plurality of images, the averaged pixel values for each pixel forming the reference image. Acks et al., on the other hand teaches that all of the plurality of the images are averaged.

More specifically, Acks et al. teaches that each pixel in the digital image sensor, averaging pixel values of the plurality of images, the averaged pixel values for each pixel forming the reference image (column 9 line 44 – column 10 line 13).

One of ordinary skill in the art at the time the invention was made would have been motivated to incorporate the teachings of Acks et al. with the teachings of Bakhle et al. because as stated in column 9 line 44 – 61 Acks et al. teaches that the averaging of multiple snap shots permits a filtering of portions of the image which do not carry over from one snap shot to the next, allowing incoherent noise to be reduced.

Regarding **claim 3**, as mentioned above in the discussion of claim 2, Bakhle et al. and Acks et al. teach all of the limitations of the parent claim. Additionally, Bakhle et al. teaches acquiring a plurality of images using the digital image sensor when the digital image sensor receives no illumination comprises: closing an aperture of the digital imaging system so that the digital image sensor is not exposed to illumination (column 5 lines 23 *et seq.*; i.e. shutter).

Allowable Subject Matter

Claims 5 – 6 and 14 - 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding independent **claim 5**, the prior art of record fails to teach or fairly suggest "storing a reference value of an operating parameter associated with the reference image comprises: **providing a dark pixel** in the digital image sensor, the dark pixel being permanently and totally shadowed; **and measuring a leakage current associated with the dark pixel when the reference image is being acquired**, wherein the **leakage current of the dark pixel is the reference value used as an indicator of the temperature** of the digital image sensor when the reference image is acquired."

Regarding independent **claim 6**, the prior art of record fails to teach or fairly suggest "measuring a current value of the operating parameter associated with the first image comprises: **measuring a leakage current associated with the dark pixel** when the first image is being acquired, wherein **the leakage current of the dark pixel is the current value used as an indicator of the temperature** of the digital image sensor when the first image is acquired."

Regarding independent **claim 14**, the prior art of record fails to teach or fairly suggest "sensor array **comprises a dark pixel** being permanently and totally shadowed, and the reference value of the operating parameter associated with the reference image comprises **a leakage current value associated with the dark pixel in the sensor array**, the **leakage current being used as an indicator of the temperature** of the digital image sensor when the reference image is acquired."

Regarding independent **claim 15**, the prior art of record fails to teach or fairly suggest "measuring a current value of the operating parameter associated with the first image comprises: **measuring a leakage current associated with the dark pixel** when the first image is being acquired, wherein **the leakage current of the dark pixel is the current value used as an indicator of the temperature** of the digital image sensor when the first image is acquired."

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Okino et al. (US patent No. 4,675,738) teaches a reference image for image correction.

Hannigan et al. (US patent No. 6,535,617) teaches fixed pattern noise removal using a composite image.

Nagaoka et al. (US PgPub 2002/0044205) teaches a look up table used in image correction using a reference image.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Usman Khan whose telephone number is (571) 270-1131. The examiner can normally be reached on Mon-Thru 6:45-4:15; Fri 6:45-3:15 or Alt. Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Ometz can be reached on (571) 272-7593. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Usman Khan
01/24/2007
Patent Examiner
Art Unit 2622

DAVID OMETZ
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